# Overview of MODIS and VIIRS L1B Top-Of-Atmosphere Reflectances and Radiances Aggregation Algorithm

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Introduction

❑ Collection 61 (C61) Moderate Resolution Imaging Spectroradiometer (MODIS) reprocessing at MODIS Adaptive Processing System (MODAPS) generated one of the longest and consistent Earth's atmosphere data record of 35 years - 18 years of Terra (2000-present) and 17 years of Aqua (2002-present). This long term data record is being continued by the Visible Infrared Imaging Radiometer Suite (VIIRS) instrument on-board the Suomi-National Polar-Orbiting Partnership (S-NPP launched in Nov 2011) and Joint polar Satellite System (JPSS1 launched in Nov 2017).

❑ The current MODIS operational C61 algorithms operate with high stability and produce superior quality science data products. Further improvements to the data products is underway by improving instrument calibration and fine tuning of the algorithm through sensitivity studies.

❑ The NPP-VIIRS NASA L1B and suite of Land products are currently operational under collection V1 reprocessing at Land SIPS and products available to public from NASA LAADS DAAC. Processing of VIIRS atmospheric products is expected to begin soon at the VIIRS Atmosphere SIPS in Wisconsin and products to be available to public from NASA LAADS DAAC.

❑ In this study we are working towards understanding the performance of science data products from each of these sensors by characterizing the top-of-atmosphere reflectances and radiances (L1B calibrated data) with respect to the sensor geometry.
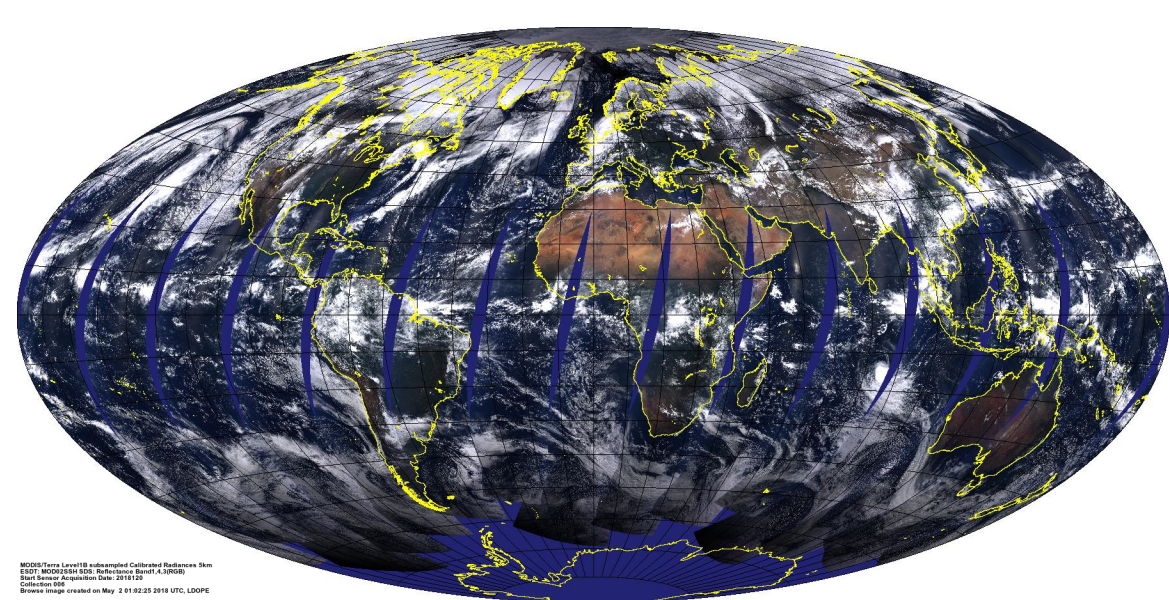
Terra MODIS L1B True color Image Band 1,4, 3 (RGB)
Day 2018120
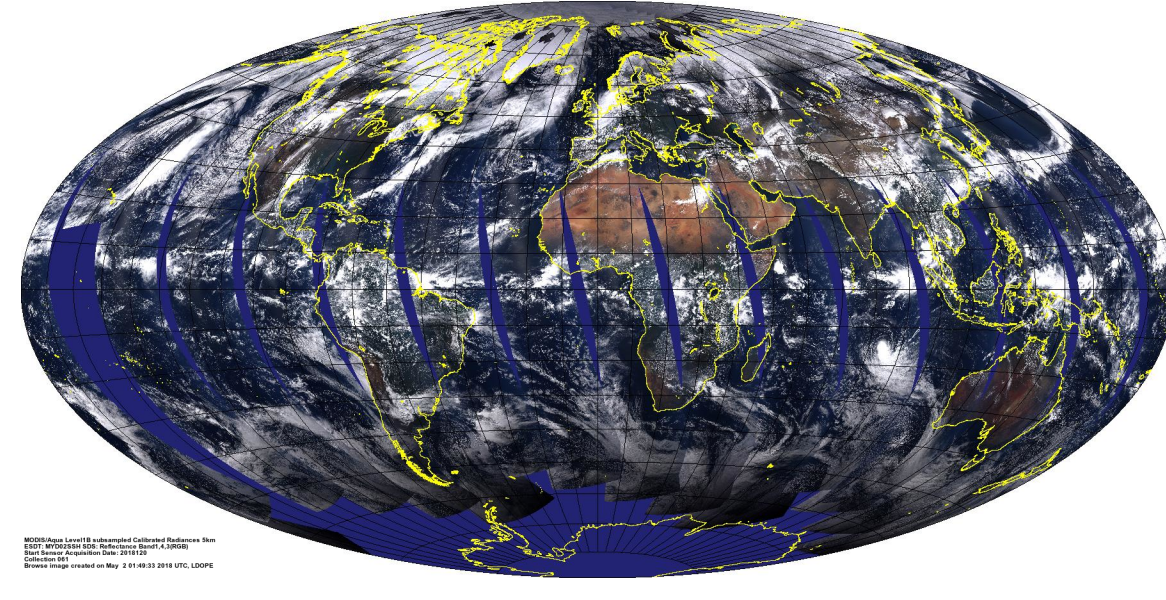
Aqua MODIS L1B True color Image Band 1,4, 3 (RGB)
Day 2018120
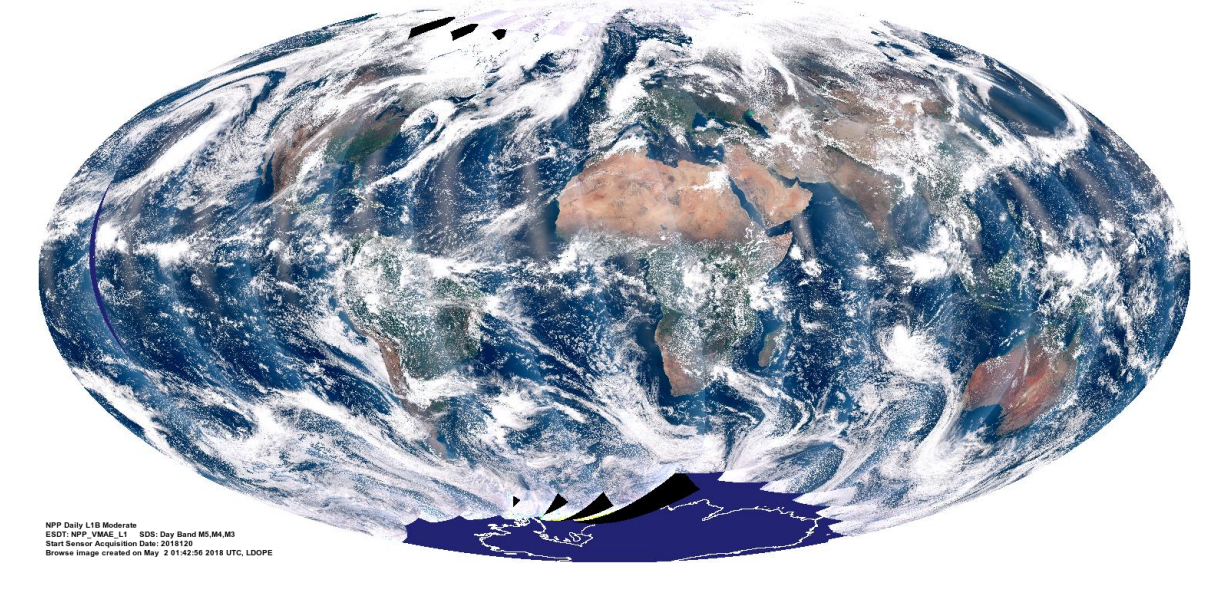
S-NPP VIIRS L1B True color Image Band M5, M4, M3 (RGB)
Day 2018120

Objective

❑ The motivation for this study is to provide the user community a seamless timeseries of data from the available sensors now and in future.

❑ This presentation describes the tool that we developed to generate a sensor zenith angle (VZA) dependent L1B top-of- atmosphere reflective and emissive data and how it can be utilized across platforms for data continuity and cross calibration.

Aggregation Algorithm

❑ This tool generates an aggregated global daily L1B sensor view angle dependent product at 5km resolution by reading the observations from all the 288 MxD02SSH (240 VNP02MODC/VNP02IMGC granules for VIIRS) granules acquired for the day.

❑ Observations are filtered to use only the day time pixels. Day time here is defined as observations with the solar zenith angle value of less than 81.36°. (Platnick et al., 2017)

❑ All the observations from multiple overpasses for the day over a grid cell are averaged.

> ❑ Orbits overlap begins around 60° (N/S) latitude reaching to a maximum of 16 orbits towards the pole for MODIS (~14 orbits for VIIRS).

❑ This intermediate global 5km product is then aggregated into equal latitude/longitude projection.

❑ And then the final aggregation to produce a 1°x1° coarser resolution data product by averaging the 5km resolution observations falling within the 1°x1° grid cell.

❑ This data is only available on request and not distributed through LAADS.

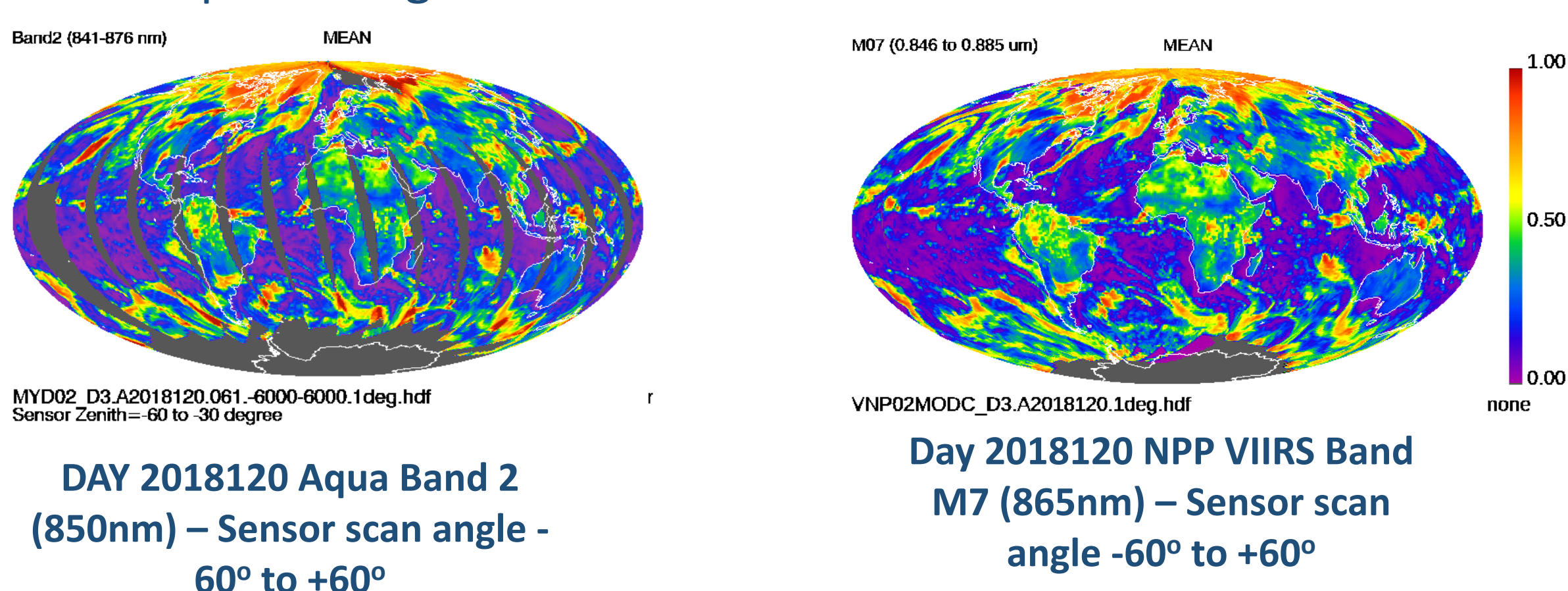❑ Currently we generate daily and monthly view angle dependent gridded L1B data.
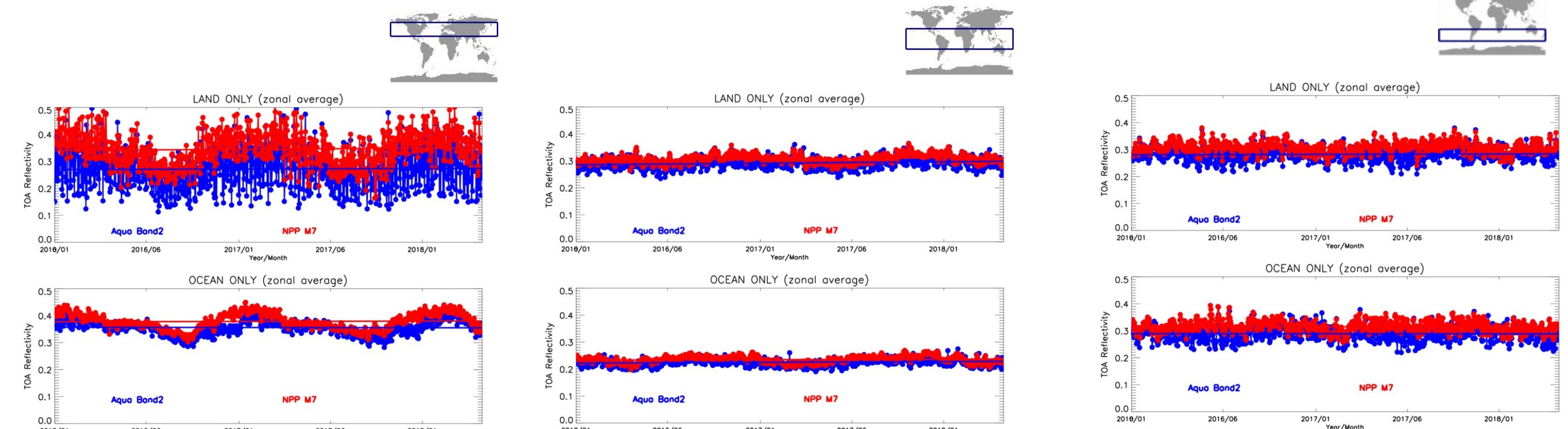
Zonal Averaged Time series Over Land and Ocean from Aqua MODIS Band 2 and NPP VIIRS Band M7 from 2016-current

Conclusions and Future Work

❑ Aggregating L1B data to coarser resolution provides us the ability to generate a climate record from multiple satellites data that will be consistent in view angle distributions, spectral bands and geolocation. And minimizes the band-to-band registration errors for bands within the same platform and also across multiple platforms.

❑ Better understanding of sensor angle dependence facilitates cross platform calibration between VIIRS and MODIS.

❑ This will also provide ways to redesign the science algorithm in future collection of VIIRS products as continuation of the MODIS records.

❑ This algorithm can be applied to any passive remote sensing satellite data in hdf4 format.

❑ A test webpage has been created to display the global browse images and time series of this L1B aggregated data

https://modis-images.gsfc.nasa.gov/vmanohar/L1B_aggr/MOD02_D3/index.htm

Refrence: Platnick, S., K. Meyer, M. D. King, G. Wind, N. Amarasinghe, B. Marchant, G. T. Arnold, Z. Zhang, P. A. Hubanks, R. E. Holz, P. Yang, W. L. Ridgway, and J. Riedi, 2017: The MODIS cloud opRcal and microphysical products: CollecRon 6 updates and examples from Terra and Aqua. IEEE Trans. Geosci. Remote Sens., 55, 502–525, doi:10.1109/TGRS.2016.2610522

DAY 2018120 Aqua Band 2 (850nm) – Sensor scan angle -60° to +60°

Day 2018120 NPP VIIRS Band M7 (865nm) – Sensor scan angle -60° to +60°

Note: The above images are reprojected in Hamer-Aitoff Projection for relative comparison with Level 3 MODIS Atmosphere Products